REMARKS

The Office Action dated June 7, 2007, and made final, has been carefully reviewed and the forgoing amendment and following remarks have been made in consequence thereof.

Claims 1-3, 6, 7, 9-13, 16, 17, 19-24, 26, and 28, and 29-31 are pending in this application. Claims 9, 19, 21-24, 26, 28, and 29 are withdrawn. Claims 1-3, 6, 7, 10-13, 16, 17, and 20 stand rejected. Claims 30 and 31 are newly added. No additional fee is due for newly added Claims 30 and 31. No new matter has been added.

The specification has been amended to conform to originally-filed Figure 1 and to clarify the differential signal processing circuit described in originally-filed Paragraph [0013] by merely adding more detail about the underlying theory of the originally-disclosed invention. Furthermore, the specification and Figures 1 and 2B have been amended to describe that which was inherent in the originally-filed specification and drawings, namely, the properties of magnetic fields and that ambient magnetic fields exist. As such, the originally-filed specification supports the amendments to the claims made herein.

Applicants wish to thank Examiner Karlsen for the courtesies he extended in a telephonic interview with William Zychlewicz and Melissa Glauber on July 24, 2007, in which the § 132 and § 112 rejections were discussed. More specifically, particular regard was made to the shape of a magnetic field and how a Hall effect device is configured to sense the shape of a magnetic field. It was agreed that a response to the Final Office Action dated June 7, 2007 would be the most appropriate response to the outstanding Office Action. No further agreement was reached.

The objection to the drawings and specification under 35 U.S.C. § 132(a) as containing new matter is respectfully traversed.

The Office Action asserts that the amendments to Figures 2A and 2B, paragraph [0007], and the newly added paragraphs after paragraph [0011] are not supported by the original disclosure. Applicants respectfully traverse this assertion.

An amendment to the drawings that merely amends the drawings and/or specification to conform to each other is not a violation of 35 U.S.C. 132(a). In re Heinle, 145 USPQ 131, 136 (C.C.P.A. 1965). Furthermore, an amendment to the specification and drawings that

merely clarifies that which the originally-filed application inherently disclosed, for example, the underlying theory of the invention, does not add "new matter" to the application. See Triax Co. v. Hartman Metal Fab., 178 USPQ 142, 146 (2d Cir. 1973); Technicon Instr. Corp. v. Coleman Instr. Inc., 150 USPQ 227, 236 (N.D. Ill. 1966). Applicants respectfully submit that the amendment to the specification and drawings merely clarifies what was inherently disclosed in the originally-filed application by amending the specification and drawings to conform to each other and to merely describe in more detail the underlying theory of the originally-disclosed invention.

Regarding Figure 2B, Applicants respectfully submit that Figures 1 and 2 and the specification of the originally-filed application support the amendment of Figure 2B because the amendment to Figure 2B amends Figure 2 to conform to the specification and to clarify the theory that inherently underlies the originally-disclosed invention. Figure 1 as originally filed shows a pair of Hall effect devices (12) having a magnetic field (B) associated therewith such that magnetic field directions oppose each other. Paragraph [0013] of the originally-filed specification describes that the magnetic field (B) is substantially perpendicular to the Hall effect device (12) and that a first magnetic field direction opposes a second direction of the magnetic field. The first direction passes through one of the Hall effect devices (12) and the second direction passes through the other Hall effect device (12). Further, Figure 2 as originally filed shows a cross-section of the conductor (16) including a magnetic field generated by current through the conductor (16), wherein the magnetic field has opposing directions that each pass through a slot (32) defined through the conductor (16).

Paragraphs [0011] and [0012] of the originally-filed specification describe that the opposing magnetic field directions are generated by the current and pass through the slot. In originally-filed paragraph [0012], the Hall effect devices (12) (shown in originally-filed Figure 1) are described as being disposed within the slot (32) (shown in originally-filed Figure 2) in the conductor (16) where the magnetic field (B) has a pre-determined spatial behavior. According to the description in Paragraph [0012], the Hall effect devices (12) as shown in Figure 1, are combined with the conductor (16) shown in Figure 2, such that the magnetic field directions in Figure 1 correspond to the magnetic field directions in Figure 2, to result in Figure 2B, as amended.

Moreover, amended Figure 2B illustrates inherent properties of a magnetic field generated by a conductor, and the amendment to the specification merely adds more detail about the originally-disclosed invention by describing inherent properties of the invention, such as, the properties of a magnetic field and the scientific theory underlying the originally-disclosed invention. Consequently, the originally-filed drawings and specification inherently and expressly provide adequate support for the amendment to the specification and Figure 2. Accordingly, Applicants respectfully submit that the amendment to the specification and drawings is not a violation of 35 U.S.C. 132(a).

For at least the reasons set forth above and having provided support for the features noted in the Office Action, Applicants respectfully request that the objection to the drawings and specification under 35 U.S.C. § 132(a) be withdrawn.

The rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement is respectfully traversed.

The Office Action asserts at page 3 that "[t]he limitation 'and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture' does not have basis in the original disclosure." Applicants respectfully traverse this assertion, and submit that such a limitation does have basis in the originally-filed specification and drawings for at least the reasons discussed regarding the rejection under Section 132. The rejected limitation is described in the amendment to the specification and drawings. As discussed above, the amendment to the drawings and specification merely clarifies that which was inherent in the originally-filed disclosure and does not violate the "new matter" rule. As such, the claims, as amended, are supported by the originally-filed specification and drawings because the limitation that the Hall effect devices are aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture is an inherent property of the originally-disclosed invention.

For at least the reasons set forth above, Applicants respectfully request that the Section 112, first paragraph rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 be withdrawn

The rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement is respectfully traversed.

The Office Action asserts at page 3 that "[i]t is not clear how plural Hall devices would be placed in the slot of the conductor 16 of Figure 2 to produce the desired result," and on page 4 that "[i]t is not cleat from the specification how the Hall effect devices of Figure 1 are to be positioned in the slot of Figure 2, or indeed, if they are to be positioned in the slot of Figure 2." The original specification recites:

> Slot 32 is designed such that a current introduced at first edge 22 is divided into two approximately equal current components. Current sensor 10 is inserted at least partially into slot 32 and facilitates detecting a magnetic field created by current carrying conductor 16. The current components then generate two magnetic field components that are shaped such that they are substantially in the opposite direction and substantially equal in magnitude.
>
> In use, a chip or a circuit board containing a pair of Hall effect devices 12 is disposed in slot 32 where a magnetic field B has the desired spatial behavior. A current is introduced into conductor 16 thereby generating a magnetic field having a pre-determined shape around conductor 16. In one embodiment, the magnetic field is shaped by slot 32 such that a pre-determined spatial dependence is introduced into the magnetic field.

Specification, page 3 lines 9-20. The original specification describes that conductor 16 and the shape of slot 32 defines the shape of the magnetic field generated by conductor 16. As is known, the strength of a magnetic field varies inversely with distance. The magnetic field has a shape based on the current flowing through conductor 16, the shape of conductor 16, the shape of slot 32, and a spatial dependence of the magnetic field is based on a distance and direction from conductor 16. As described in the original specification above, a pair of Hall effect devices 12 is disposed in slot 32 where the magnetic field has the desired spatial behavior. Further, as illustrated in original Figures 1 and 2, Hall effect devices 12 may be disposed in slot 32 such that a magnetic field B shown in original Figure 1 substantially aligns with the magnetic field as shown in original Figure 2. The original specification further describes that:

> Hall effect devices 12 are placed a pre-determined distance from each other such a Hall effect device 12 can detect

> least a first magnetic field component having a first direction and another Hall effect device can detect a second magnetic field component having a second direction different from the first direction. The magnetic field B components are created in such a way that they substantially change direction over a relatively short distance.

Specification, page 4 lines 9-15.

Claim 1 recites "a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture, said conductor is configured to generate a magnetic field having pre-determined lines of force, each said Hall effect device configured to generate a first output based on said generated magnetic field and a second output based on an ambient magnetic field." Independent Claims 10, 11, and 20 include similar recitations. As explained above, Applicants submit that the originally-filed specification and drawings clearly describe how plural Hall devices of Figure 1 would be placed in the slot of the conductor 16 of Figure 2 to produce generate an output based on the pre-determined lines of force.

The Office Action also asserts that:

> No disclosure is present explaining how to configure each Hall effect device to detect the predetermined shape of the magnetic field. The Examiner is not aware that a Hall effect device can detect a predetermined shape of a magnetic field. It is further not clear how the Hall effect devices would be configured to be insensitive to fields other than the fields of predetermined shape. It is not clear what the predetermined shape would be that the Hall effect devices would sense.

Office Action dated June 7, 2007, page 4. The Office Action further asserts on page 4 that "[t]he Examiner does not understand what is meant by configuring a Hall plate." Applicants respectfully submit that it is well known in the art that magnetic fields have three dimensional shapes that are routinely described using equations and can easily be visualized using a magnet, a sheet of paper, and some iron filings. For example, Figures 2 and 3 of the prior art reference cited in the § 102(e) rejections in the present Office Action illustrates how the shape of a conductor can affect the shape of the magnetic field surrounding the conductor. Additionally, it is known that the strength of a magnetic field varies inversely with distance

and position with respect to the magnetic field source, in the present instance, the right and left legs of conductor 16.

However, in order to expedite prosecution, Applicants have amended to the claims to delete "shape" and, rather, to recite "lines of force." Further, the claims have been amended to delete that "the Hall effect device being configured to be insensitive to magnetic fields having shapes other than the pre-determined shape," and, rather, to recite that the current sensor is configured to reduce an output generated by an ambient magnetic field. The specification has also been amended to add more detail describing lines of force, as are known in the art, and how the output generated by the ambient magnetic field is reduced by the configuration of the current sensor.

The Office Action further asserts:

> The specification states in paragraph 0011 that the current in conductor 16 is divided into two equal components. It would appear that such would result in equal and opposite fields in slot 32 which would cancel resulting in a zero field. How the sensor of Figure 1 could detect a zero field is unclear.

Office Action dated June 7, 2007, page 4. One such way the Hall effect devices 12 may be positioned in slot 32 such that the Hall effect device 12 are configured to generate an output based on the pre-determined shape of the magnetic field generated by conductor 16 is by aligning the Hall effect devices 12 in the plane of conductor 16 perpendicularly to a longitudinal axis of slot 32. Hall effect devices 12 would each indicate an output due to each sensor 12 receiving a larger component of the magnetic field from one of the legs than the magnetic field component from the other leg. The output of each Hall effect current sensor 12 output is determined relative to a shape of conductor 16, a shape of the magnetic field generated by current components 34 and 36 and a distance from and a position relative to conductor 16. Such spatial dependence between each Hall effect current sensor 12 and each leg of conductor 16 permits determining the shape of the magnetic field generated by conductor 16.

The Office Action also asserts on page 4 that "[i]t is unclear how the circuitry of Figure 4 is structured," and "[s]ome elements are not connected to anything." Applicants respectfully submit that Figure 4 is a block diagram of a Hall effect based electronic electricity meter and not a schematic diagram or wiring diagram where all wiring connections

may be expected to be shown explicitly. The block diagram of Figure 4 and the associated specification portion that describes Figure 4 is submitted to describe an embodiment of an electricity meter such that one skilled in the art of electricity meters to make and/or use the invention.

Accordingly, Applicants submit that one skilled in the art, after reading the specification, would understand the recitations of the presently pending claims.

For at least the reasons set forth above, Applicants respectfully submit that Claims 1, 10, 11, and 20 satisfy Section 112, first paragraph.

Claims 2, 3, 6, 7, 12, 13, 16, and 17 depend, directly or indirectly, from independent Claims 1, 10, 11, and 20. When the recitations of Claims 2, 3, 6, 7, 12, 13, 16, and 17 are considered in combination with the recitations of Claims 1, 10, 11, and 20, Applicants respectfully submit that dependent Claims 2, 3, 6, 7, 12, 13, 16, and 17 likewise satisfy Section 112, first paragraph.

For at least the reasons set forth above, Applicants respectfully request that the Section 112, first paragraph rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 be withdrawn.

The rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 under 35 U.S.C. § 112, second paragraph, is respectfully traversed, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention is respectfully traversed.

The Office Action asserts on page 5 that "[i]t is not clear what is meant by the conductor being configured to generate a magnetic field having a predetermined shape, the Hall effect device being configured to detect a magnetic field of predetermined shape or the Hall effect device being configured to be insensitive to magnetic fields having shapes other than the pre-determined shape." As described above, the magnetic field generated by a flow of electrical current is defined by the direction and magnitude of the current flow. The magnetic field surrounds the conductor such that a three-dimensional shape of the magnetic field surrounding the conductor is determinable in accordance with embodiments of the present invention. Because the magnetic field is spatially dependent, for example, has different values of direction and magnitude at different points surrounding conductor 16, a

shape of the magnetic field may be ascertained by measuring the strength and direction of the magnetic field at a plurality of points surrounding conductor 16.

However, in order to expedite prosecution, Applicants have amended the claims to delete "shape" and, rather, to recite "lines of force." Further, the claims have been amended to delete that "the Hall effect device being configured to be insensitive to magnetic fields having shapes other than the pre-determined shape," and, rather, to recite that the current sensor is configured to reduce an output generated by an ambient magnetic field.

As such, Applicants respectfully submit that Claims 1, 10, 11, and 20 are definite and distinctly claim the subject matter of the invention. Accordingly, Applicants respectfully request withdrawal of the Section 112, second paragraph, rejection to Claims 1, 10, 11, and 20.

Claims 2, 3, 6, 7, 12, 13, 16, and 17 depend, directly or indirectly, from independent Claims 1, 10, 11, and 20. When the recitations of Claims 2, 3, 6, 7, 12, 13, 16, and 17 are considered in combination with the recitations of Claims 1, 10, 11, and 20, Applicants respectfully submit that dependent Claims 2, 3, 6, 7, 12, 13, 16, and 17 likewise satisfy Section 112, second paragraph.

For at least the reasons set forth above, Applicants respectfully request that the Section 112, second paragraph rejections of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 be withdrawn.

The rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 under 35 U.S.C. § 102(e) as being anticipated by Ladds (U.S. Patent 6,040,690) ("Ladds") is respectfully traversed.

Ladds describes an electricity measurement apparatus that includes two spaced-apart parallel conductors through which current flows in the same direction inducing a magnetic field between the conductors. Two magnetic field sensors are disposed on each side of a first plane in which the conductors lie. The sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane. An arithmetic processor processes signals from the sensors to provide a value representative of current flow. The provided value is substantially independent of the position of the second plane within the space between the conductors.

Claim 1 recites a current sensor for an apparatus, said current sensor comprising "a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture, said conductor is configured to generate a magnetic field having pre-determined lines of force, each said Hall effect device configured to generate a first output based on said generated magnetic field and a second output based on an ambient magnetic field, said current sensor configured to combine the first output with the second output such that the second output is reduced."

Ladds does not describe nor suggest a current sensor as recited in Claim 1. Specifically, Ladds does not describe nor suggest a current sensor including a conductor including an aperture therethrough and a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. Moreover, Ladds does not describe or suggest a current sensor including Hall effect devices configured to generate a first output based on a generated magnetic field and a second output based on an ambient magnetic field, wherein the current sensor is configured to combine the first output with the second output such that the second output is reduced. Rather, Ladds describes two magnetic field sensors disposed on each side of a first plane in which the conductors lie, wherein the sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Ladds.

Claims 2, 3, 6, and 7 depend from independent Claim 1. When the recitations of Claims 2, 3, 6, and 7 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2, 3, 6, and 7 likewise are patentable over Ladds.

Claim 10 recites a current sensor for an apparatus comprising "a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture, said conductor is configured to generate a magnetic field comprising at least a first

magnetic field component having a first direction and a second magnetic field component having a second direction different from said first direction, and having pre-determined lines of force, each said Hall effect device configured to detect said generated magnetic field and generate a first output and to detect an ambient magnetic field and generate a second output, said current sensor configured to combine said first output and said second output such that said second output is reduced."

Ladds does not describe nor suggest a current sensor as recited in Claim 10. Specifically, Ladds does not describe nor suggest a current sensor including a conductor including an aperture therethrough and a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. Moreover, Ladds does not describe or suggest a current sensor including Hall effect devices configured to detect a generated magnetic field and generate a first output and to detect an ambient magnetic field and generate a second output, wherein the current sensor is configured to combine the first output and the second output such that the second output is reduced. Rather, Ladds describes two magnetic field sensors disposed on each side of a first plane in which the conductors lie, wherein the sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane.

Accordingly, for at least the reasons set forth above, Claim 10 is submitted to be patentable over Ladds.

Claim 11 recites a residential electricity meter comprising "a voltage sensor and a current sensor, said current sensor comprising a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture, said conductor is configured to generate a magnetic field having pre-determined lines of force, each said Hall effect device configured to detect said generated magnetic field and generate a first output and to detect an ambient magnetic field and generate a second output, and said current sensor configured to combine said first output and said second output such that said second output is reduced."

Ladds does not describe nor suggest a residential electricity meter as recited in Claim 11. Specifically, Ladds does not describe nor suggest a current sensor including a conductor including an aperture therethrough and a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. Further Ladds does not describe nor suggest a current sensor including Hall effect devices configured to detect a generated magnetic field and generate a first output and to detect an ambient magnetic field and generate a second output, wherein the current sensor is configured to combine the first output and the second output such that the second output is reduced. Rather, Ladds describes two magnetic field sensors disposed on each side of a first plane in which the conductors lie, wherein the sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane.

Accordingly, for at least the reasons set forth above, Claim 11 is submitted to be patentable over Ladds.

Claims 12, 13, 16, and 17 depend from independent Claim 11. When the recitations of Claims 12, 13, 16, and 17 are considered in combination with the recitations of Claim 11, Applicants submit that dependent Claims 12, 13, 16, and 17 likewise are patentable over Ladds.

Claim 20 recites a residential electricity meter comprising "a voltage sensor and a current sensor, said current sensor comprising a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture, said conductor is configured to generate a magnetic field comprising at least a first magnetic field component having a first direction and a second magnetic field component having a second direction different from said first direction and pre-determined lines of force, each said Hall effect device configured to detect said generated magnetic field and generate a first output and to detect an ambient magnetic field and generate a second output, said current sensor configured to combine said first output and said second output such that said second output is reduced."

Ladds does not describe nor suggest a residential electricity meter as recited in Claim 20. Specifically, Ladds does not describe nor suggest a current sensor including a conductor

including an aperture therethrough and a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. Further, Ladds does not describe nor suggest a current sensor including Hall effect devices configured to detect a generated magnetic field and generate a first output and to detect an ambient magnetic field and generate a second output, wherein the current sensor is configured to combine the first output and the second output such that the second output is reduced. Rather, Ladds describes two magnetic field sensors disposed on each side of a first plane in which the conductors lie, wherein the sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane.

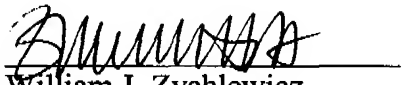
Accordingly, for at least the reasons set forth above, Claim 20 is submitted to be patentable over Ladds.

For at least the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 be withdrawn.

Newly added Claims 30 and 31 depend from independent Claim 1, which Applicants submit is patentable over the cited art. For at least the reasons set forth above, Applicants respectfully submit that Claims 30 and 31 are also patentable over the cited art

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully requested.

Respectfully Submitted,



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